EPA tosses aside safety data, says Dow pesticide for GMOs won't harm people

Weedkiller's revival is cause for concern

Patricia Callahan, Chicago Tribune
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When Monsanto genetically engineered corn and soybeans to make them immune to its best-selling weedkiller, the company pitched the technology as a way to reduce overall use of herbicides and usher in an environmentally friendly era of farming.

Instead of relying on older, more harmful chemicals, farmers could douse their fields with Roundup, a product that Monsanto once advertised as less toxic than table salt.

Two decades later, overuse of Roundup has spawned weeds that can survive spraying to grow 8 feet tall with stems as thick as baseball bats. To kill those so-called superweeds, chemical giants are giving the next wave of genetically modified crops immunity to the weedkillers of generations past.

The technology that was supposed to make those older herbicides obsolete soon could make it possible for farmers to use a lot more.

For use on its new genetically engineered corn and soybeans, Dow Chemical Co. is reviving 2,4-D, a World War II-era chemical linked to cancer and other health problems.

If these crops are widely adopted, the government's maximum-exposure projections show that U.S. children ages 1 to 12 could consume levels of 2,4-D that the World Health Organization, Russia, Australia, Korea, Canada, Brazil and China consider unsafe.

The U.S. Environmental Protection Agency had considered that exposure dangerous for decades as well. But the Obama administration's EPA now says it is safe to allow 41 times more 2,4-D into the American diet than before he took office.

To reach that conclusion, the Tribune found, the agency's scientists changed their analysis of a pivotal rat study by Dow, tossing aside signs of kidney trouble that Dow researchers said were caused by 2,4-D.

The EPA scientists who revised that crucial document were persuaded by a Canadian government toxicologist who decided that Dow — a company that has a $1 billion product at stake — had been overly cautious in flagging kidney abnormalities that she deemed insignificant.

When Dow later published this study, the company's scientists likewise dismissed their earlier concerns and changed the most important measure of the chemical's toxicity so it agreed with the EPA's less stringent view.

These decisions paved the way for the EPA to approve Dow's weedkiller, Enlist Duo, last year and reassure the public that a surge in 2,4-D use wouldn't hurt anyone.

Girding that reassurance are two calculations: How much of the herbicide is safe for human health, and how much will Americans wind up consuming? There are ways to tweak each of those risk calculations. With 2,4-D, the Tribune found, the EPA's math favored a dramatic increase in the weedkiller.

Federal law has required the EPA to protect children from pesticides — chemicals that kill weeds, insects or other harmful organisms — since a National Research Council panel warned lawmakers in the 1990s that exposing fetuses and young kids to these compounds can cause lifelong damage at doses that wouldn't hurt their parents.

Dr. Philip Landrigan, the pediatrician who chaired that panel, is so alarmed by the potential spike in children's exposure to 2,4-D that for the last year he has urged EPA Administrator Gina McCarthy to reject the "notoriously toxic herbicide." He is calling for the federal National Toxicology Program to assess the safety of the mix of weedkillers that would be used on new genetically modified crops.

When Landrigan learned from the Tribune that EPA and Dow scientists had changed their minds about kidney anomalies found in exposed rats, he was shocked.

"If the tables were turned, and a group of scientists published a paper showing some adverse effect from 2,4-D, I have no doubt that Dow would say a second and third study were needed," said Landrigan, whose research on childhood lead exposure helped prompt the removal of lead from gasoline and paint. "And yet, Dow is saying we need to trust this one study where results were reinterpreted midstream. There's reason to raise doubt here."

Dow said 2,4-D is safe and is one of the most extensively studied pesticides in history. James Bus, a former Dow toxicologist who worked on the company's recent rat study, said the EPA's evaluation of 2,4-D relies on state-of-the-art science and "stands

as an example of how it should be done."

"We know from 70 years of exposure that 2,4-D has not presented health problems," Bus said. Studies that suggest such a link are flawed, and increased use will not put anyone at risk, he added.

For its part, the EPA said its scientific vetting ensures that any pesticide residues left in food and water won't cause harm. The Dow rat study reveals that 2,4-D is less toxic to people than once thought, agency officials say.

"It is EPA's understanding that other governments do agree with our interpretation of the new study, but have not yet incorporated the results into their 2,4-D reviews," EPA spokeswoman Cathy Milbourn said in a written statement.

In a surprise move last week, the EPA asked the U.S. 9th Circuit Court of Appeals to vacate the agency's approval so its scientists could review new data. But EPA officials made it clear they don't intend to bar the product permanently.

The holdup has nothing to do with human health. Enlist Duo combines 2,4-D and glyphosate, the main ingredient in Roundup, and the agency said it wanted to iron out concerns that the two chemicals combined are more toxic to endangered plants than either of the chemicals separately.

As far as people's health is concerned, though, the agency maintains that Enlist Duo is perfectly safe. Even if American farmers spray 2,4-D on every acre of corn and soybeans — crops that serve as the building blocks of processed foods and fatten farm animals — it still won't harm consumers, the EPA said.

So confident is Dow that the agency's concerns about endangered plants can be resolved quickly that the title of its news release last week read: "Dow Expects Enlist Duo to be Available for the 2016 U.S. Crop Season."

Today 94 percent of soybeans and 89 percent of corn planted in the U.S. are genetically engineered to survive herbicides, primarily the glyphosate in Roundup. But no one is comparing glyphosate to table salt anymore, with the WHO's cancer research agency now labeling it a probable carcinogen. And no one is hailing it as an agricultural savior.

More than 60 million acres of U.S. cropland are being choked by weeds that glyphosate can't kill. In response, chemical companies and federal regulators are advising farmers not to substitute one weedkiller for another but to add more.

Even some scientists who have spent their professional lives eradicating weeds oppose the new genetically modified crops and the chemical future they foreshadow.

"Those herbicide increases are not OK," said David Mortensen, a professor of weed and applied plant ecology at Pennsylvania State University. "To me, that is unconscionable that we can be OK with that, and I'm not an anti-chemical radical."

How much is too much?

Many people complain that eating genetically modified food could endanger their health. But it's the weedkillers used on genetically modified crops, not the corn and soy, that scientists have repeatedly found to cause harm.

Herbicides linger in the water Americans drink, in the air they breathe and on the foods they eat. Children are especially vulnerable because they take in more food, water and air, relative to their weight, than adults.

That's why scientists study weedkillers so closely and why regulators scrutinize them more heavily than other industrial chemicals.

The fact that 2,4-D was a main component of the Vietnam War-era defoliant Agent Orange made the chemical infamous, even though it was dioxin contamination of a different ingredient that brought harm to troops and villagers.

Over the years, federal and university researchers showed 2,4-D was worrisome on its own. Studies found increased odds of developing non-Hodgkin lymphoma, hypothyroidism and Parkinson's disease among people who used the chemical as part of their jobs. In June, the WHO's cancer research agency ruled that 2,4-D is a possible carcinogen.

But EPA scientists aren't convinced that 2,4-D causes any of those diseases because other studies reached different conclusions.

Though it wasn't widely used on corn and soybeans, 2,4-D has been a go-to chemical for wheat growers, ranchers and golf course groundskeepers. When the EPA in the early 2000s revisited the safety of 2,4-D as part of a wider review of pesticides long on the market, the goal was to determine from animal testing how much 2,4-D people could safely consume.

Such tests are carried out or commissioned by chemical-makers, even though they have a vested interest in the results.

The EPA relied on a 1995 Dow study that found rats dosed daily with 75 milligrams of pure 2,4-D per kilogram of body weight (or mg/kg) over a two-year period gained less weight and experienced changes in kidney, thyroid, liver, lung, reproductive organ and blood chemistry measures compared with untreated rats.

Rats that consumed the next lowest dose — 5 mg/kg — showed no ill effects. This is called the "no observed adverse effect level," and it's the most important measure in a pesticide toxicity study.

Next came a series of math exercises. As they always do, EPA officials divided that dose by a factor of 100 to account for the fact that rats and humans are different and some people have heightened sensitivity to chemicals.

Since the mid-1990s, the EPA has been required to divide again — this time by a factor of 10 — because Landrigan's panel found children are more vulnerable than adults. This protection may be removed only if "such margin will be safe for infants and children."

In the case of 2,4-D, the EPA kept it in place because its scientists couldn't tell whether 2,4-D disrupts hormones, immunity and neurological development.

When the dividing was done, the EPA under President George W. Bush set the acceptable daily intake of 2,4-D at 0.005 mg/kg. Separate calculations showed that nobody was consuming too much, the EPA said at the time.

That same year, 2005, the EPA ordered the manufacturers to conduct two new studies that could answer the remaining questions about safety — research that ultimately would lead to the weakening of consumer protections.

One study was to expose adult rats and two generations of offspring to 2,4-D while looking for immune system problems, thyroid effects and toxicity in other organs. Another would scrutinize neurological development in offspring.

But with the EPA's permission, Dow rolled the studies into one and halted what would become the most important evaluation of 2,4-D after breeding just one generation of rats.

Dow's study design, which called for breeding a second generation only if certain problems were evident in the first, was crafted by a committee of the ILSI Health and Environmental Sciences Institute, a nonprofit that receives much of its funding from chemical, food and pharmaceutical companies.

The committee included scientists from pesticide giants Dow, Syngenta, Bayer and DuPont, as well as one from Exponent, a scientific consulting firm. In addition to providing regulatory help to pesticide-makers and other companies, Exponent is "the go-to firm at the top of the pyramid" for companies that face a lawsuit, a product recall or a government crackdown, Exponent's financial chief told Wall Street analysts this year.

One of the few EPA members on the committee later went to work for Exponent. Bus, who helped lead the Dow study, joined Exponent after he retired; he still consults for Dow on 2,4-D.

Officials from the EPA and Dow say the committee's study design rigorously assesses many potential toxic effects from conception to adulthood while sacrificing fewer animals. The Organization for Economic Cooperation and Development, consisting of 34 countries, agrees and uses it as an international testing guideline.

But Paul Foster, a top toxicologist at the National Toxicology Program, said the study design has such "serious scientific weaknesses" that his arm of the federal government won't use it in its research. For example, the Dow study exposed rats to

2,4-D for four weeks before they mated. Foster said dosing should last 10 weeks to cover the entire time it takes rats to make sperm.

Moreover, though a 2011 analysis of 498 studies concluded the second generation "will very rarely provide critical information," Foster said it's important to find those rare instances of harm.

"Everyone wants to use the minimum number of animals to generate quality data, but there comes a time when you don't want to cut the corners too much," Foster said.

Bus said EPA and Canadian regulators, who reviewed data while the study was in progress, decided breeding a second generation wasn't warranted.

In 2010, Bus and his colleagues reported the results in a poster presentation at the Society of Toxicology's annual meeting. By then, Dow's field trials had demonstrated the genetically modified crops were viable, and the march of superweeds foretold potentially big sales.

The poster stated that 2,4-D did not cause immune, reproductive or neurological harm. Some rats experienced thyroid hormone changes, and some males had lighter-weight reproductive organs, but Dow scientists took the position that these effects were not adverse.

But they did find a problem with the kidneys. The poster said exposure-related kidney lesions occurred at a lower dose in male rat offspring than in their parents.

When two EPA scientists examined the Dow data that year, they came to the same conclusion. Both Dow and the EPA decided the no-adverse-effect level was the smallest dose tested in the offspring, an amount equivalent to about 7 mg/kg, records show.

Then something curious happened. The EPA and Dow scientists changed their minds.

More becomes OK

Six months later, the same EPA scientists revised the executive summary of their report, changing the crucial measure of toxicity.

The lesions that Dow scientists found in offspring at 7 mg/kg weren't harmful after all, EPA scientists Linda Taylor and Elizabeth Mendez wrote. They changed the no-adverse-effect level so that it was the same for both the rat offspring and parents: an amount equivalent to 21 mg/kg.

Dana Vogel, who oversees the EPA division that assesses herbicide health effects, told the Tribune the original report by Taylor and Mendez was based on "preliminary data — not the entire study but the first part of the study that came in."

In fact, there was nothing preliminary about the data, and no details were missing. The facts that Taylor and Mendez later cited to justify the change were all part of their original 108-page report, which scrutinized blood test results, organ weights and microscopic analysis at every stage of life.

Their observations were minutely detailed, describing the kidney problem as "a degenerative lesion involving the proximal convoluted tubules in the outer stripe of the outer zone of the medulla, which was multifocal in distribution."

What really led to the change of heart, interviews and an EPA document show, was a phone call from a Canadian pesticide regulator.

Lauri Stachiw was the Canadian government toxicologist who reviewed Dow's data as the study was unfolding. Stachiw told the Tribune she called Taylor and Mendez because she disagreed with their report.

Stachiw noted that Dow researchers found the kidney lesions only in male offspring at that lower dose and classified them as "very slight to slight degeneration" rather than severe. Those rats didn't have heavier kidneys, a different sign of trouble. For true toxicity, Stachiw said, she would expect moderate or severe lesions as well as heavier kidneys in those rats.

Though Dow scientists thought the lesions were harmful, Stachiw said: "I think they were just trying to be as conservative as possible, but being as conservative as possible isn't always correct science."

Stachiw, now retired, added, "If you cut your finger, it's an effect. Is it adverse compared to cutting your finger off? No."

In an interview, Mendez said she and Taylor looked at the data again after Stachiw called. Mendez said they decided the lesions Dow had labeled as toxic effects were actually a healthy response.

"It's a good thing that the kidney is gearing itself up for battle to get rid of the compound from the body," she said. Taylor declined to comment.

Bus, the Dow consultant, said the company did not influence Stachiw or the EPA. He said Dow was surprised when the EPA revised the no-adverse-effect level.

"We were totally out of the loop," Bus said.

When the Society of Toxicology's journal published the Dow study results in 2013, the article said the kidney lesions in the rat offspring dosed with 7 mg/kg "were judged to be not treatment related."

Bus said he and his colleagues adopted the position of the Canadian and EPA scientists. "It's not uncommon for reviewers to say, 'Wait a minute, we have an alternative interpretation of your data,'" he said. "... I would not have serious disagreement with how they interpreted that data."

Industry-funded researchers have found kidney trouble before in animals consuming low doses of 2,4-D, the Tribune found. An industry group representing Dow and other 2,4-D manufacturers submitted five studies to the EPA in the 1980s that documented kidney abnormalities in rats and mice at doses far lower than the one the agency now is using to set safety levels for people.

EPA scientists and the trade group agreed three decades ago that the kidney was the "target organ for toxicity" with anomalies seen at doses as low as 5 mg/kg, records show.

Bus said of those studies: "Earlier conclusions that might have been interpreted as adverse may not be considered adverse in more modern science."

Asked whether studies should be discounted when they're that old, the National Toxicology Program's Foster said, "You can look at the differences in study quality, but the way we remove kidneys and look at them under a microscope has not changed in the last 60 or 70 years."

The EPA's Mendez said her agency considered the "whole gamut of studies."

When she and Taylor raised the no-adverse-effect level to 21 mg/kg, they paved the way for the agency to reduce consumer protections.

EPA scientists had no remaining questions about the chemical's harmful effects, and there was no longer evidence of the special susceptibility of children because the revised view of the Dow study held that the toxic effects in the offspring occurred at the same dose as in the parents. So, the agency dropped the tenfold child-safety factor.

Rather than dividing the rat dose by 1,000, as it had done a decade ago, the agency divided only by 100, resulting in a far less protective limit. Regulators set the allowable daily intake of 2,4-D for people at 0.21 mg/kg, 41 times more than the government had previously considered safe.

This was a victory for Dow because the calculations made it easier for the EPA to approve the new uses of 2,4-D the company needed in order to market its genetically modified crops. The agency could tell consumers these new uses wouldn't be harmful.

The Environmental Working Group, a nonprofit that is among those suing the EPA for approving Enlist Duo, scrutinized the Dow study results outlined in the EPA's official human health risk assessment. That document didn't mention that Taylor and

Mendez had revised their interpretation.

Even so, a scientist for the nonprofit independently settled on the same measure of toxicity that the EPA and Dow initially had used: 7 mg/kg.

The group concluded that agency officials had "contradicted standard scientific practice" in choosing as their no-adverse-effect level a dose at which rats actually suffered multiple toxic effects — not just the kidney lesions but also the thyroid and reproductive organ changes.

That group also argued that the agency by law must apply the child-safety factor to its risk calculations because the offspring were more susceptible than the parents. Under that reasoning, the allowable daily intake would be 0.007 mg/kg.

The EPA's own worst-case exposure estimates, included in the official human health assessment, found toddlers could wind up consuming three times more than that.

Yet the agency, responding to critics, reassured the public that its scientists had determined that nobody would consume too much, even using the hypothetical limit of 0.007 mg/kg.

When the Tribune asked how that could be possible, the agency said its scientists made additional calculations based on more realistic assumptions of exposure, describing that step as a standard practice.

Those calculations, records show, estimated that toddlers could consume 0.0066 mg/kg of 2,4-D — just four ten-thousandths shy of the hypothetical limit.

The math, once again, worked in 2,4-D's favor.

A chemical future

At last year's Farm Progress Show in the heart of Iowa, Dow unveiled its vision of the future of American agriculture: rows of lush soybeans and towering corn plants genetically engineered to withstand 2,4-D and glyphosate.

This year, Dow didn't bother to plant those crops for the farm show held in Decatur, Ill. On display instead was an air of inevitability.

Ben Kaehler, Dow AgroSciences' U.S. sales leader, was there to extol the benefits of the crops. But rather than convincing farmers that the technology works, Kaehler tried to persuade them to plant Dow's offerings rather than Monsanto's proposed crops, which are immune to glyphosate and dicamba, a 1960s weedkiller.

The question wasn't whether to plant the next generation of genetically modified crops — it was which of those crops to plant.

On a faux brick wall in the Dow tent, a Wrigley Field-style scoreboard pitted Dow against Monsanto. Each inning featured a question about the crops or the different weedkillers, with salespeople revealing the answers one by one. Overhead, a banner beckoned: "Grow your field of dreams."

At that point, the only holdup for Dow was China, a major buyer of U.S. crops. Grain elevators here still are waiting for China's approval before agreeing to handle the new crops.

Now Dow also must address the concerns EPA raised last week about Enlist Duo's effects on endangered plants. An agency scientist noticed that a patent application for the product said it had "synergistic weed control" properties that made glyphosate and 2,4-D "more effective in combination than when applied individually."

Previously, the agency had maintained that the two chemicals were no more toxic together than they were on their own. That's why the health assessment of Dow's weedkiller hinged solely on the new risks posed by 2,4-D. Glyphosate already is widely used on corn and soybeans.

The EPA has asked the appellate court to rescind its approval of Enlist Duo while agency scientists decide whether a bigger no-

spray zone is needed near the edge of farm fields. Dow said it's confident the issue can be resolved before spring planting.

The EPA told the Tribune it isn't reopening its human health risk assessment. William Jordan, deputy director of the agency's Office of Pesticide Programs, said the combination of 2,4-D and glyphosate doesn't create added risk for people. Jordan cited tests in which researchers gave large one-time doses of Enlist Duo to rats, rabbits, birds and fish, then monitored the animals for two weeks. There was no increased toxicity from the mixture, he said.

Landrigan, the pediatrician whose work led to the lead-paint ban, is more concerned about the long-term health effects of the chemical mixture. One-time doses and short-term monitoring don't address that.

The EPA said it has no plans to ask Dow for studies that chronically dose rats with the combination of 2,4-D and glyphosate.

For anyone concerned about exposure to toxic weedkillers, a different disclosure in Dow's patent applications may be more telling.

The company's application for its genetically modified corn and soybeans foreshadows the day when weeds develop resistance to glyphosate and 2,4-D. Dow, these records show, envisions adding traits to corn and soybeans so they can survive being sprayed with weedkillers from up to 17 different chemical families.

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